



National Centers for Environmental Information Center for Weather & Climate Update on Regional Climate Services

Tim Owen, Chief, CWC Information Services

NOAA National Weather Service
National Climate Services Meeting
May 9, 2016



Revealing the Past, Interpreting the Present, and Informing the Future

Merger of NOAA Data Centers

- Part of Strengthening NESDIS
- Approved in the Consolidated and Further Continuing Appropriations Act, 2015, Public Law 113-235
- Build upon the full spectrum of weather/climatic, oceanographic, coastal, and geophysical products and services that the Data Centers previously delivered
- Provide consistent data management capability for all of NOAA



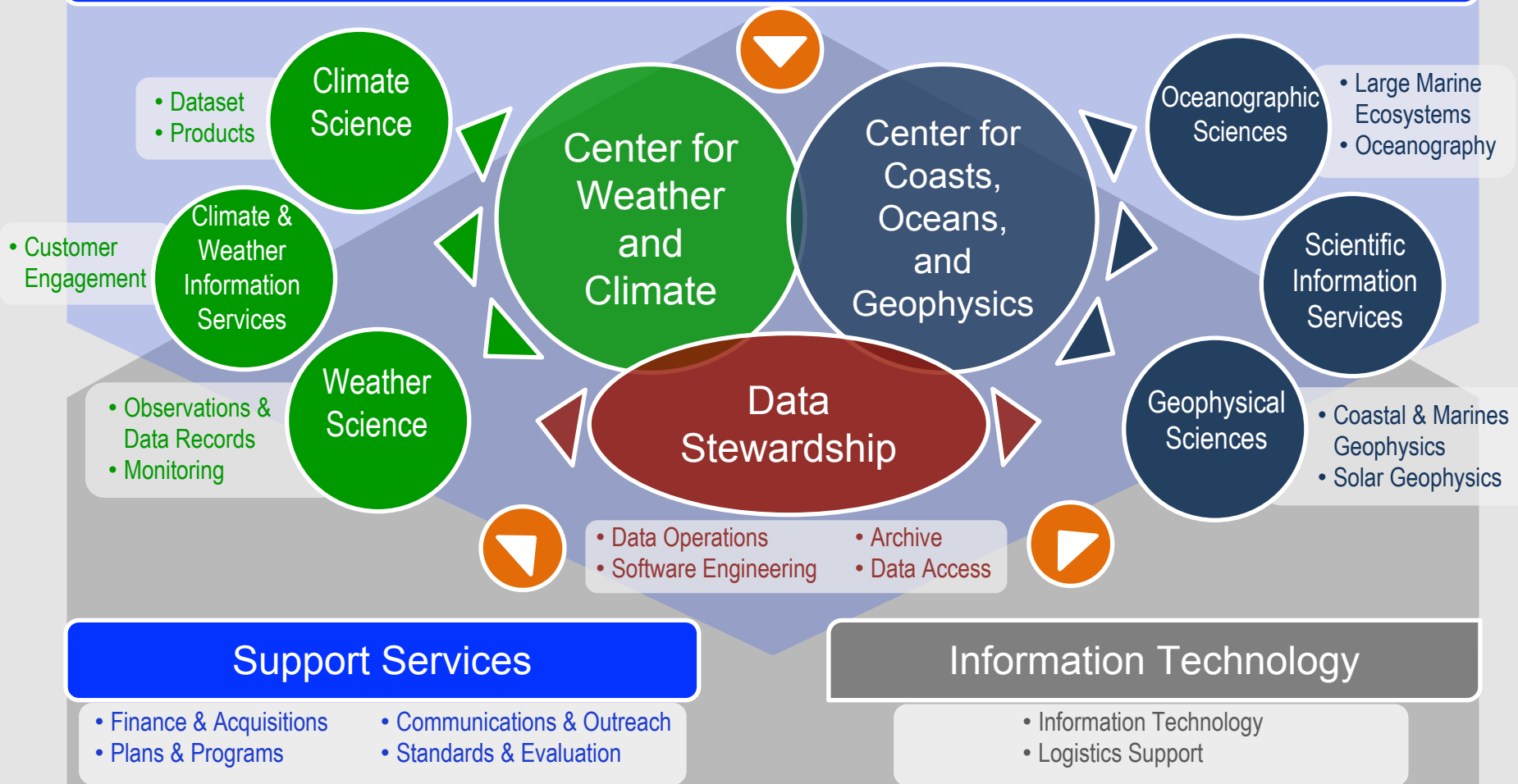
National Centers for Environmental Information

- Responsible for hosting and providing access to one of the most significant archives on Earth, with comprehensive oceanic, atmospheric, and geophysical data
- From the depths of the ocean to the surface of the sun and from million-year-old sediment records to near real-time satellite images
- Nation's leading authority for environmental information



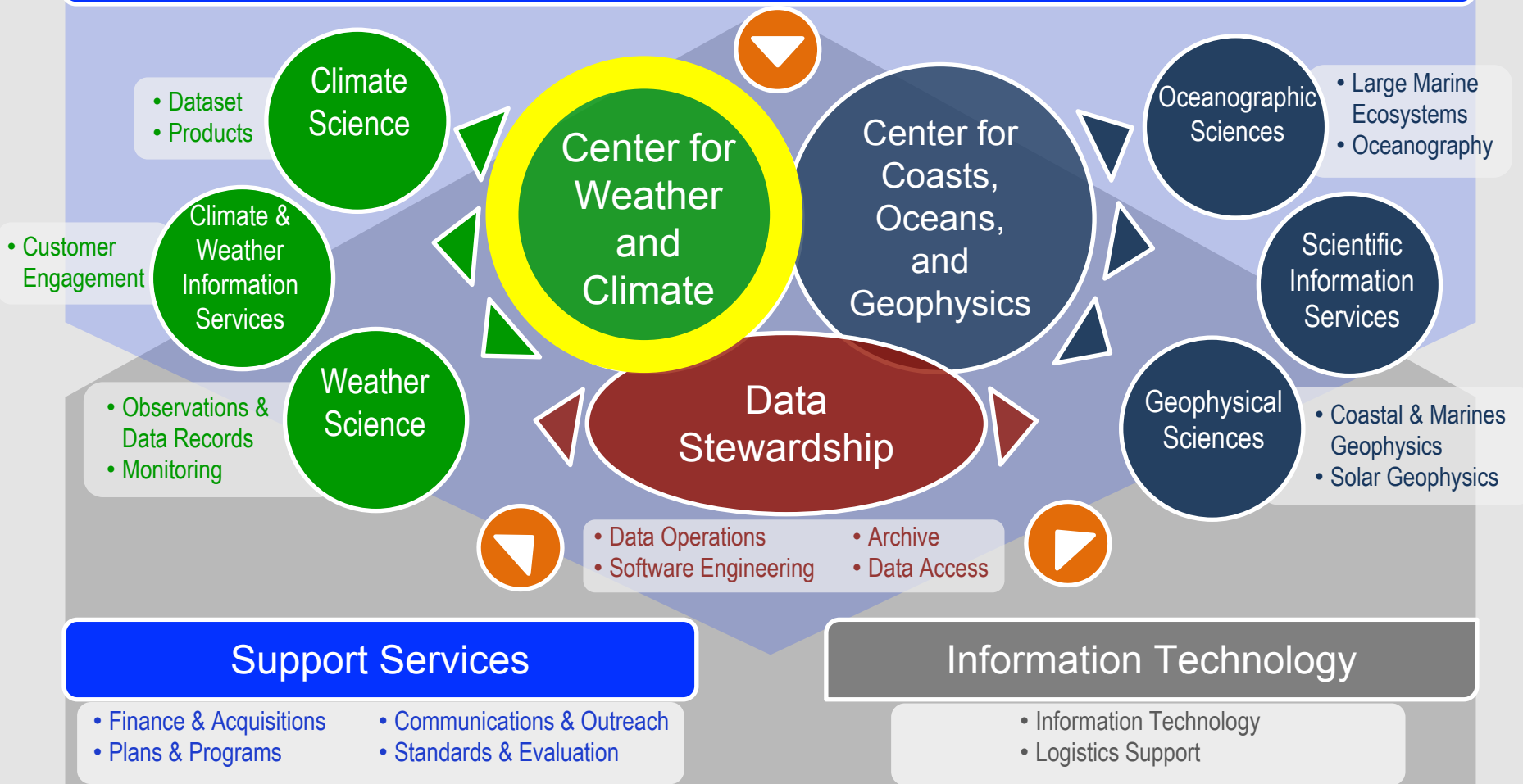
National Centers for Environmental Information Functional Organization

NCEI Director's Office



National Centers for Environmental Information Functional Organization

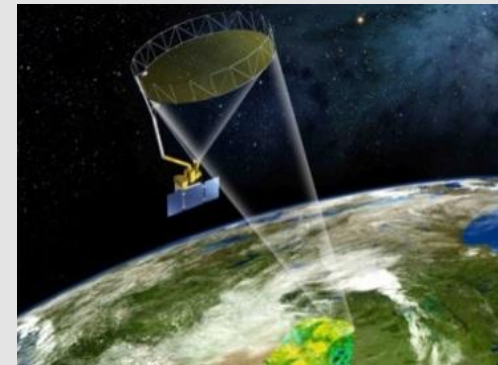
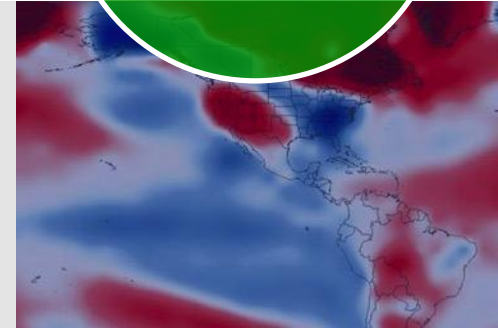
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Weather and Climate

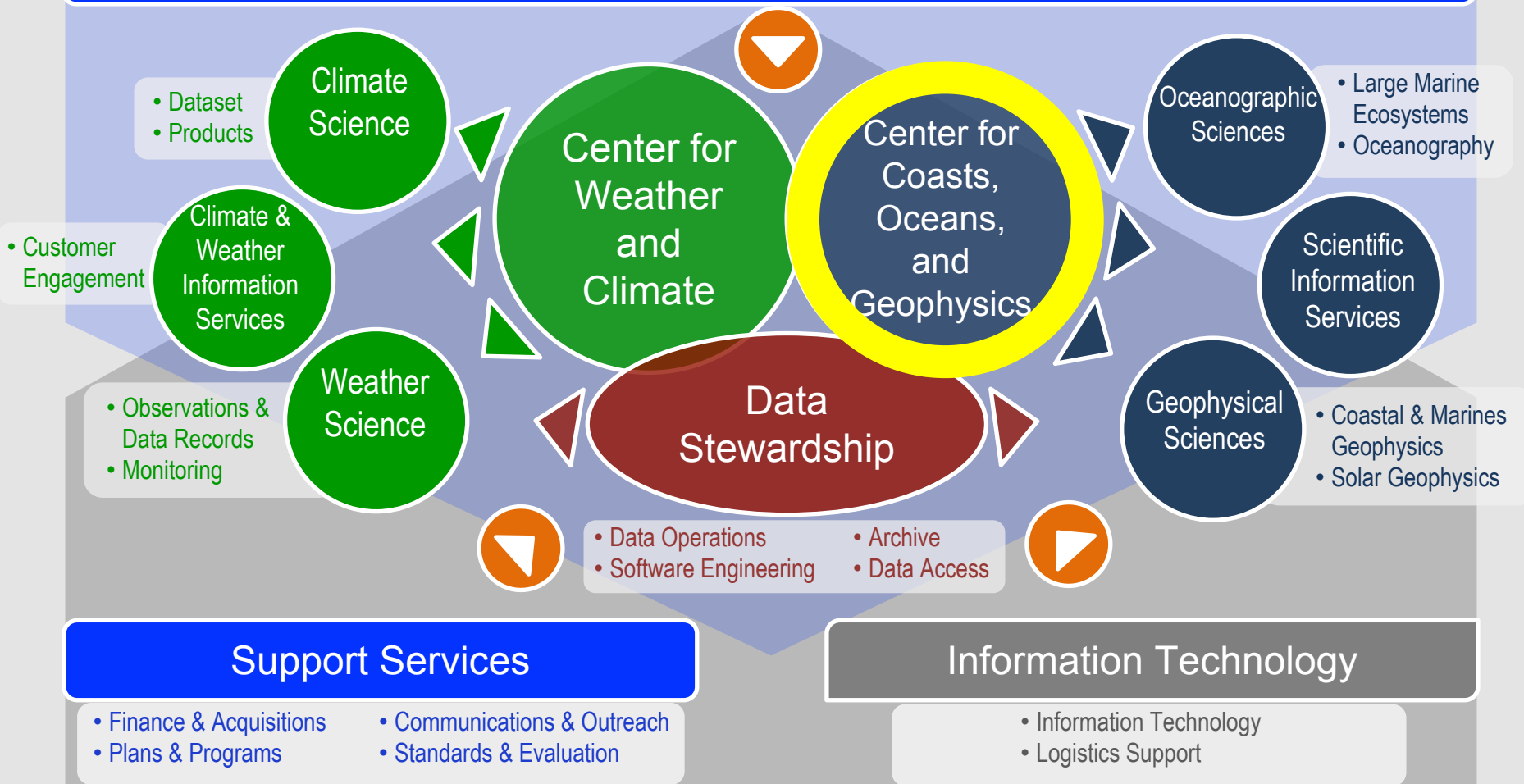
Center for
Weather
and
Climate

- World's largest weather and climate data archive with records ranging from paleoclimatology data to centuries-old journals to data less than an hour old
- Data are from land-based weather and climate stations, ships, buoys, weather balloons, radar, satellites, and comprehensive weather and climate models
- A suite of information products is available to describe the national and global climate and to monitor the state of the weather and climate variations, extremes, and trends



National Centers for Environmental Information Functional Organization

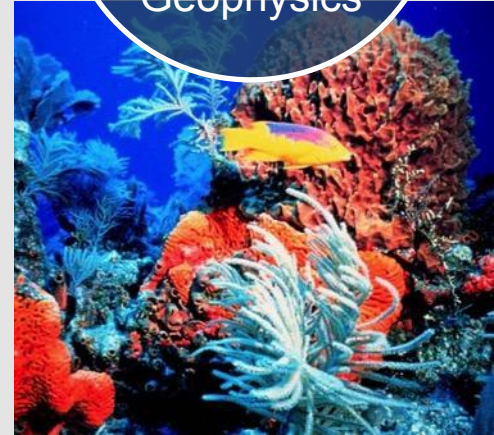
NCEI Director's Office



Oceans and Coasts

Center for
Coasts,
Oceans,
and
Geophysics

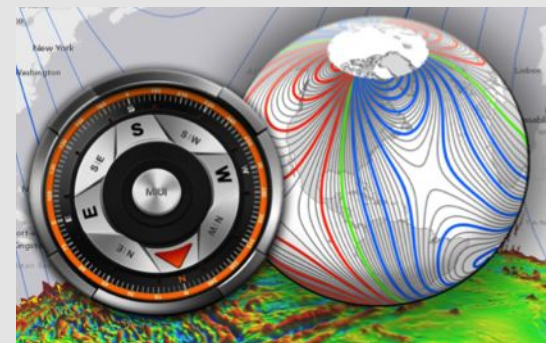
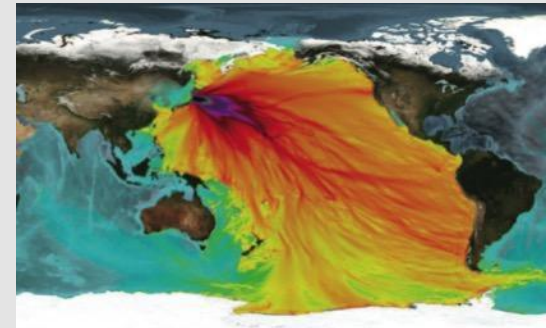
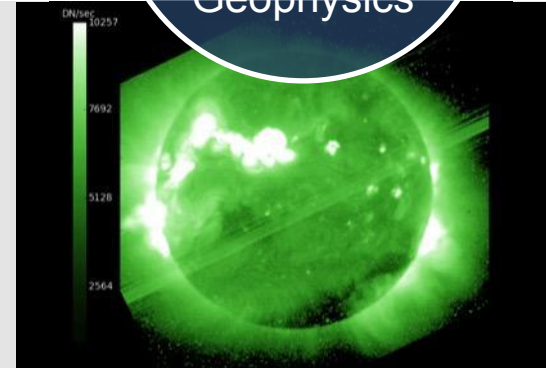
- World's largest archive of oceanographic and coastal data, ranging from water temperatures dating to the late 1700s to present day ocean salinity, nutrients, waves and currents
- Data are from ocean and coast observations, ships, buoys, satellites, remote sensing, and ocean model simulations
- Products and data are used to answer questions about ocean and coast phenomena, management of coastal and marine resources, natural disasters, and marine transportation



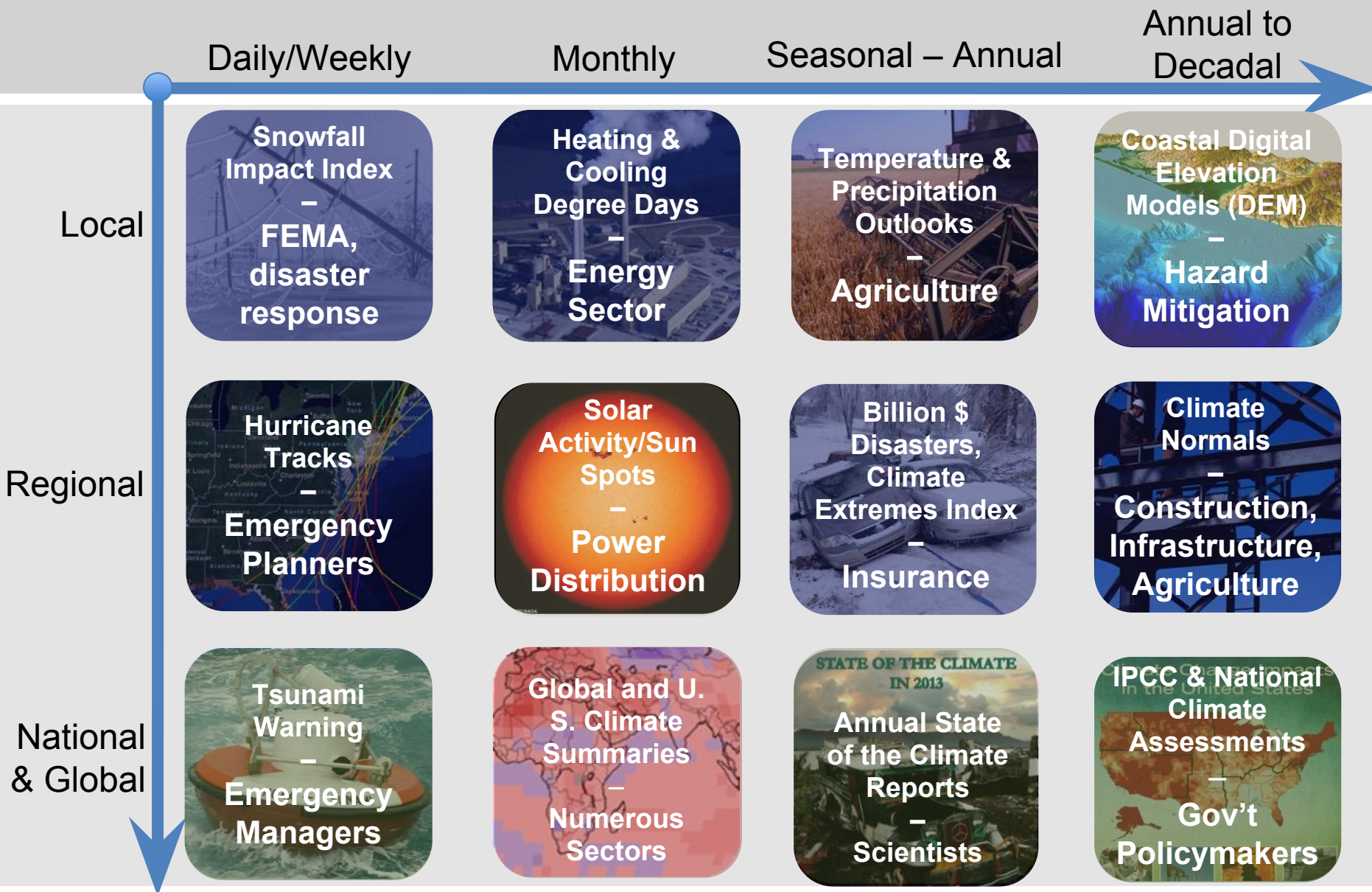
Geophysics

Center for
Coasts,
Oceans,
and
Geophysics

- Nation's geophysical data archive ranging from the surface of the sun to the Earth's seafloor and from the solid earth environment to weather in space
- Data are from satellites, space observations, ships, and models provides information on tsunamis, the U.S. Extended Continental Shelf, coastal Digital Elevation Models, geomagnetism, solar, and terrestrial
- Products and data support safe navigation both in space and on our oceans and coasts including the Arctic and the information needed in tsunami forecasting, sea level rise prediction, and storm surge inundation

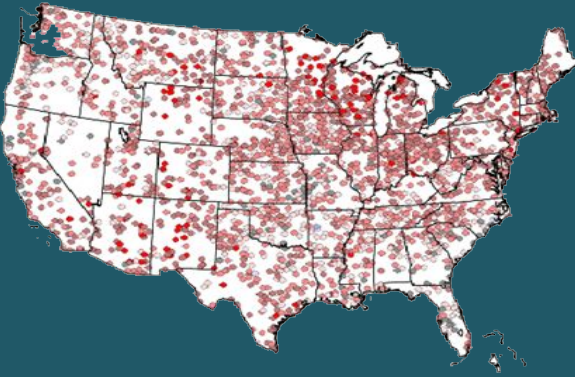


NCEI Spatial and Temporal Span

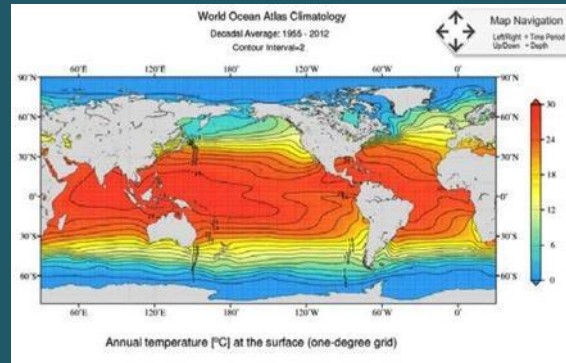


NCEI Reference Products

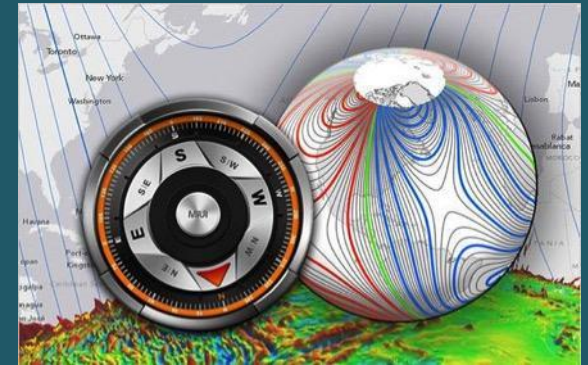
Climate Normals



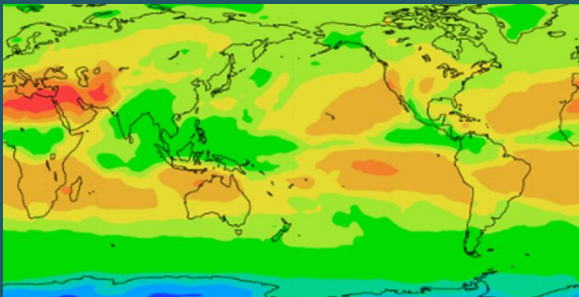
World Ocean Atlas



Earth's Magnetic Field



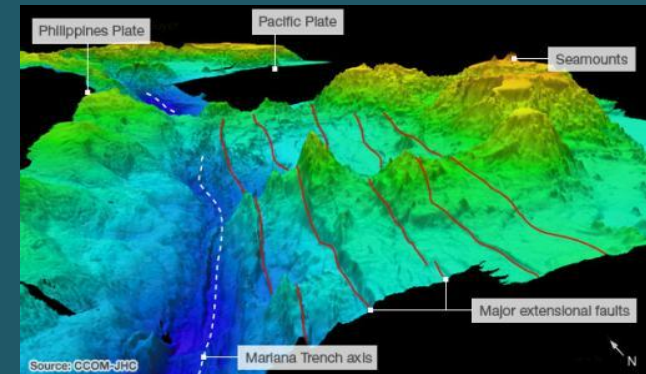
Reference Environmental Data Records



Gulf of Mexico Data



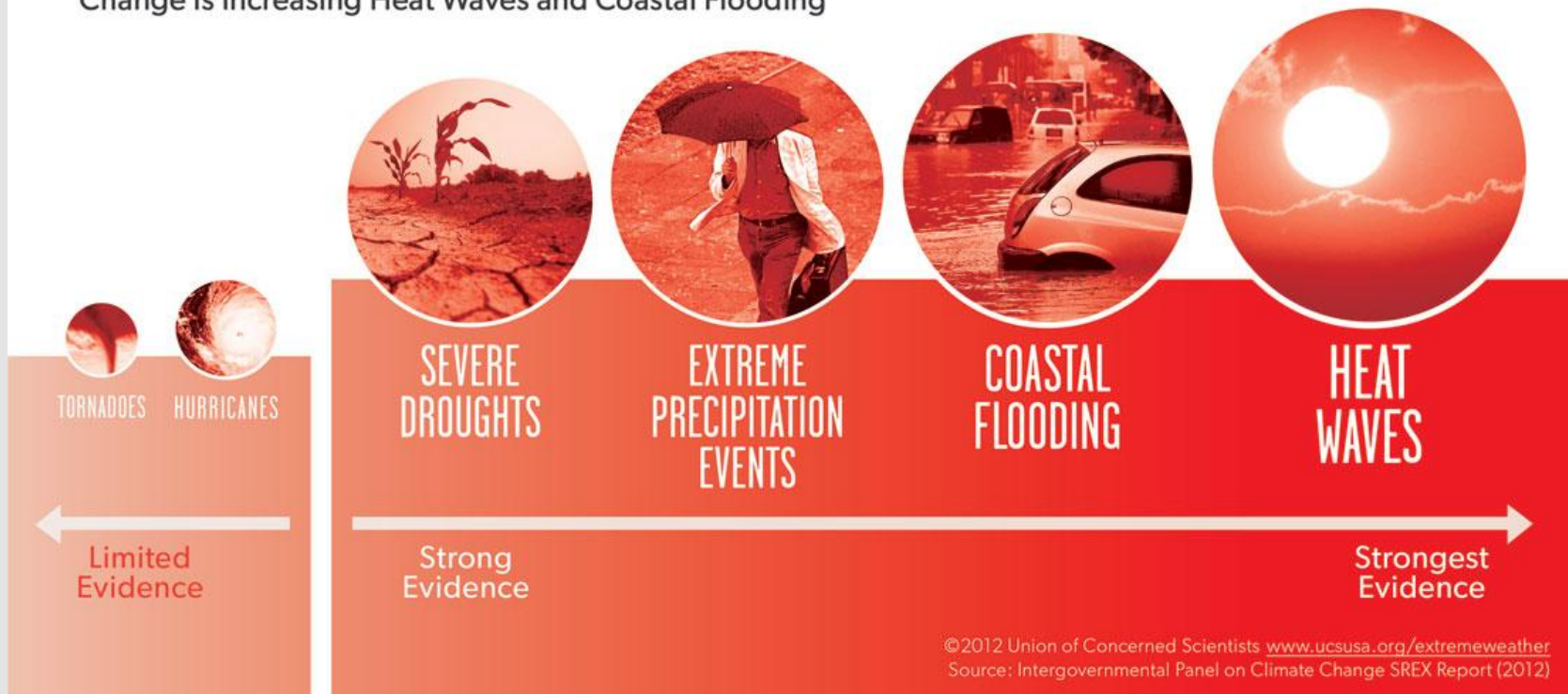
Coastal/Ocean Depths



Assessing Extreme Weather

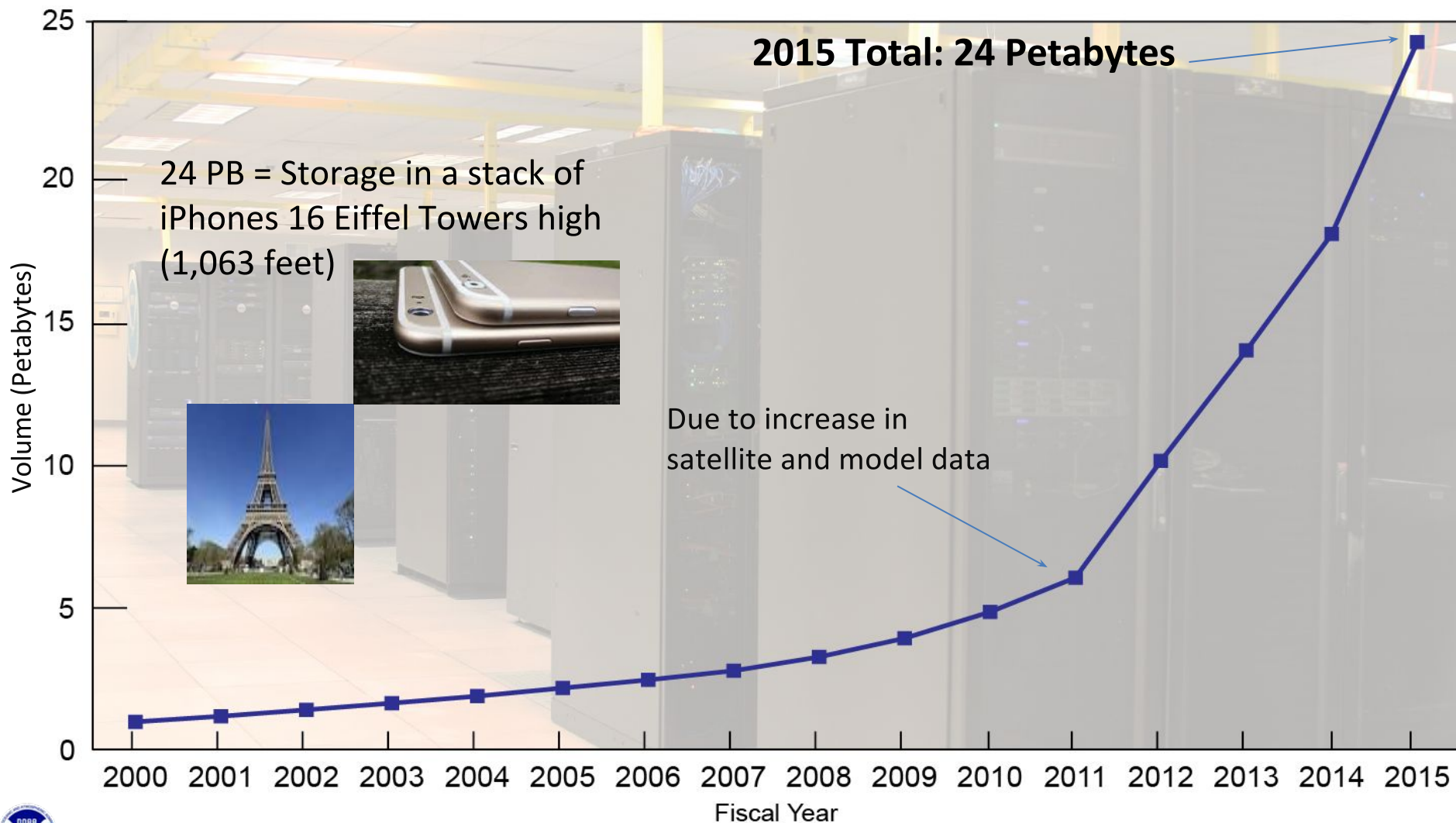
SCIENCE CONNECTIONS → EXTREME WEATHER & CLIMATE CHANGE

→ Strongest Scientific Evidence Shows Human-Caused Climate Change Is Increasing Heat Waves and Coastal Flooding



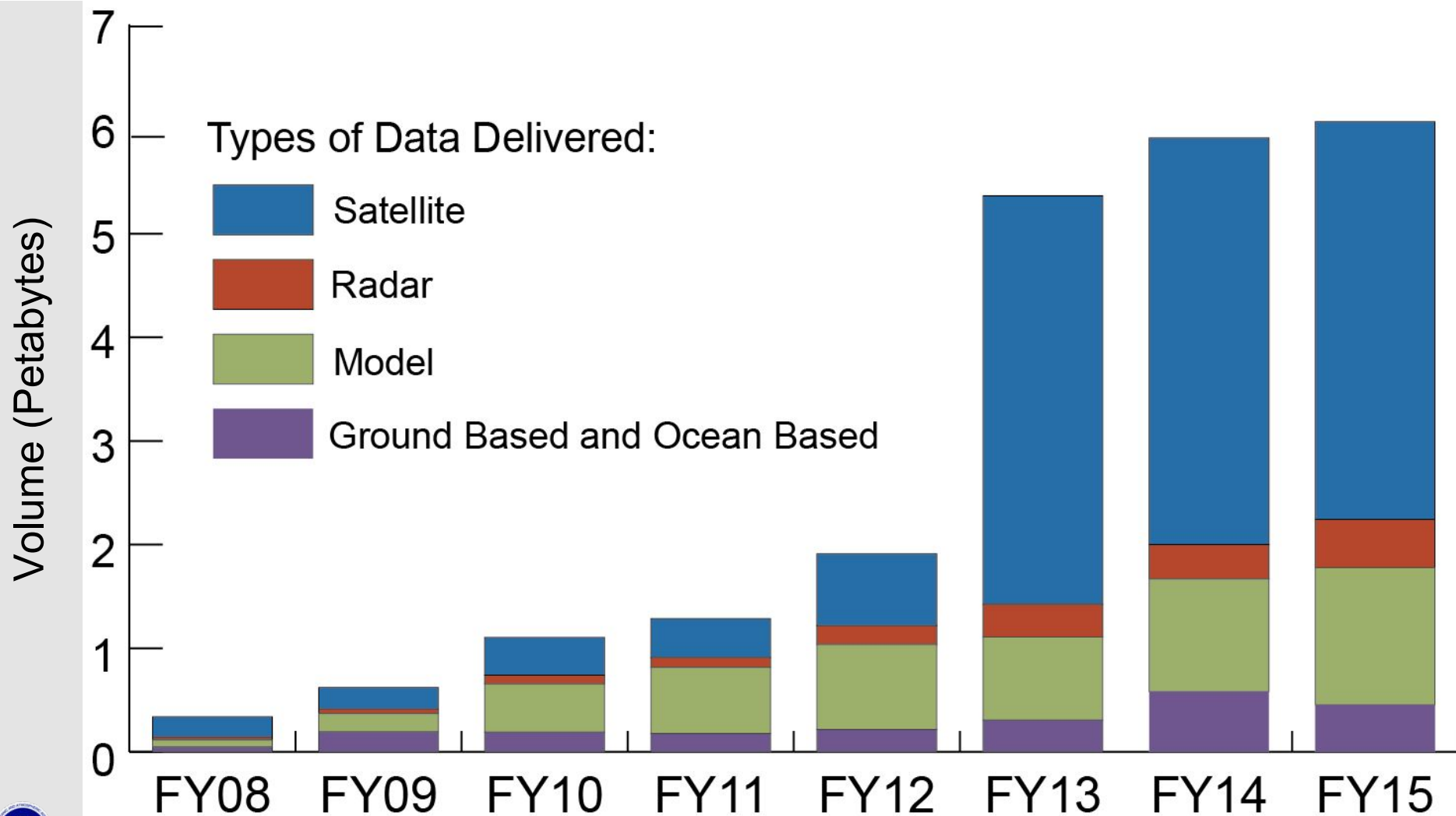
NCEI Environmental Data Archive Volume

Increasing Data Volumes from Station, Model, Radar, and Satellite Sources



NCEI Environmental Data User-Requested Volume

Increasing Data Requests from Station, Model, Radar, and Satellite Sources



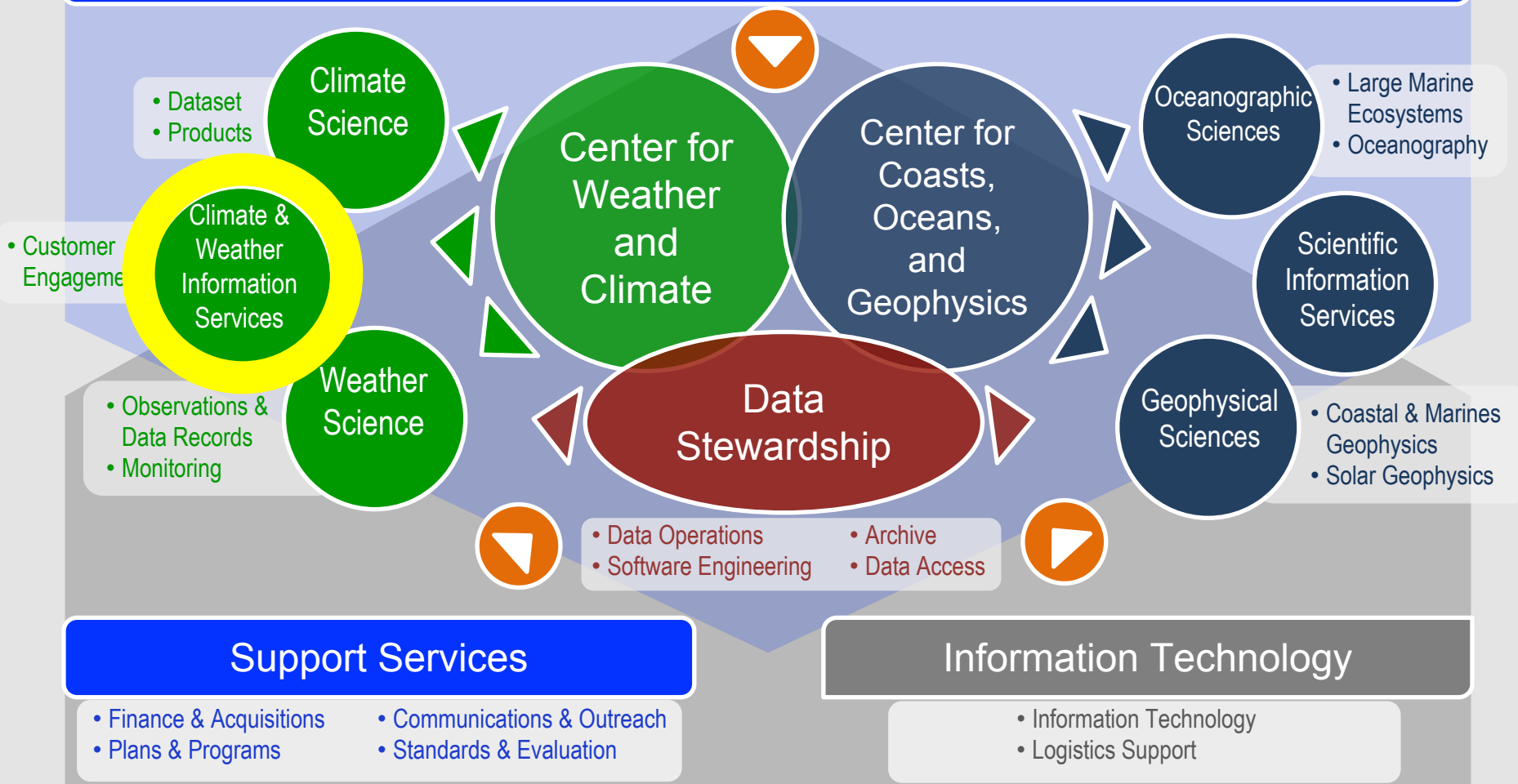


NCEI's General User Profile

Fraction (%)	Typical User	Data or Info Need	Preferred Format	Access Volume	Access Frequency
~70	General business, media, public	Qualitative	Point-and-click, graphics, assessments	Low	High
~15	Researchers, business consultants	Quantitative	Digital downloads	High	Low
~15	Value-added Providers (database scrapers)	Quantitative	Digital downloads machine to machine	Low	High

National Centers for Environmental Information Functional Organization

NCEI Director's Office



 Includes NCEI Regional Climate Services

Rising Demand for Climate Information with Regional Perspectives



Sustainability of Marine
Ecosystems



Coasts and Climate Resilience



Climate Impacts on
Water Resources



Changes in Extremes of
Weather and Climate



Agriculture



Energy



Health

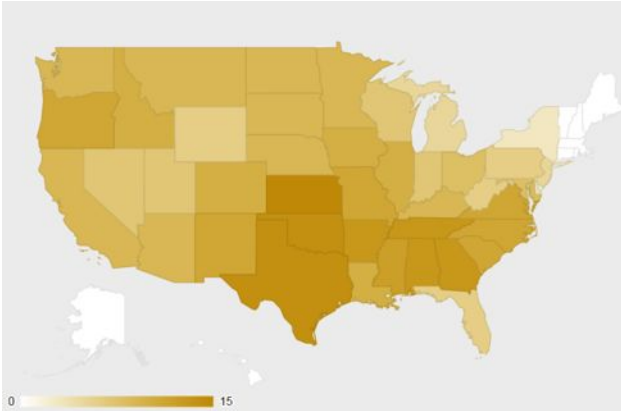


Transportation

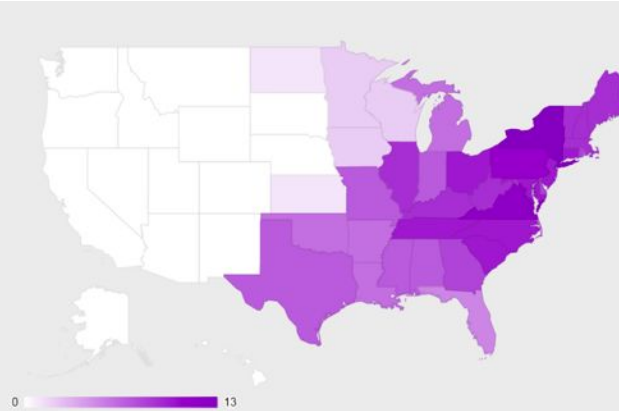
Regional Impacts of Weather and Climate

U.S. Billion-Dollar Weather and Climate Disasters: 1980 – 2015*

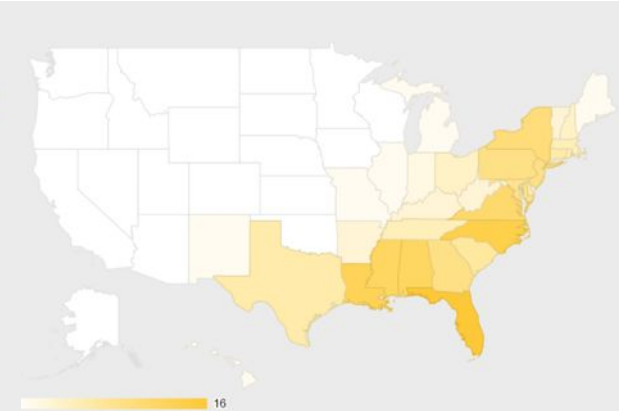
Droughts and Heat Waves



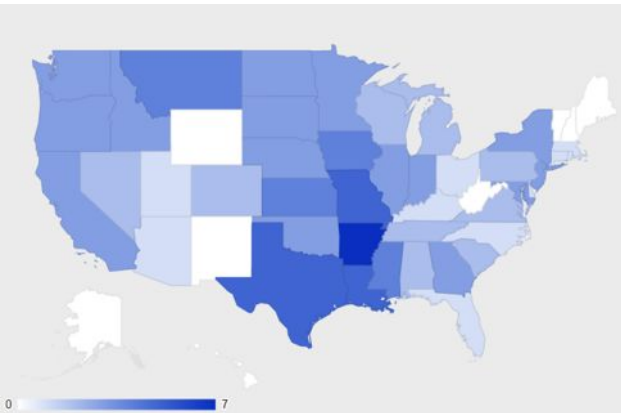
Winter Storms



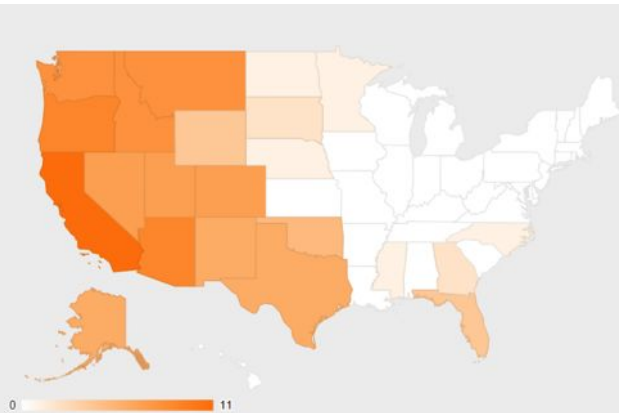
Tropical Cyclones



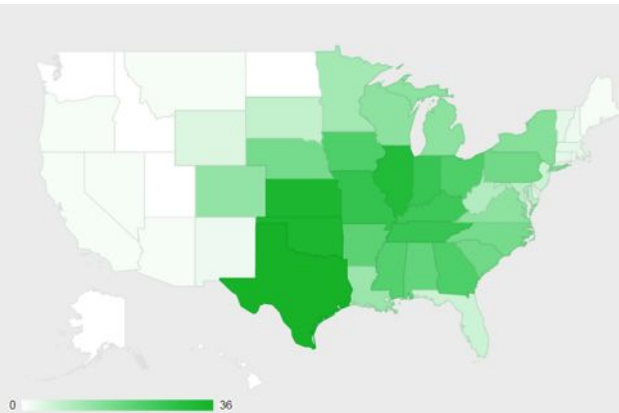
Flooding



Wildfires



Severe Local Storms



*188 weather and climate disasters reached or exceeded \$1 billion during this period (CPI-adjusted)

Please note that the map reflects a summation of billion-dollar events for each state affected (i.e., it does not mean that each state shown suffered at least \$1 billion in losses for each event).

NCEI – Climate and Weather Information Services

Deliver Use-Inspired Environmental Information Products and Services that Supports the Nation's Prosperity and Resilience

Provide Products and Services

Expand and Enrich Use of NCEI's Environmental Information



Understand Users

Understand User Needs and Translate Them Into Requirements



Strengthen Networks

Strengthen Networks for Developing and Delivering NCEI's Products and Services



Provide Products and Services



*Expand and Enrich Use
of NCEI's Environmental Information*

- **Sectoral Engagement**

- Targeted sectors by

Economic impact
Environmental vulnerability
Engagement readiness

- **Regional Engagement**

- Quarterly outlooks and regional executive forums



*AMS – Energy Forum
Jan 2016*



*ASCE– Coastal Indicators
Forum - May 2016*



*RTP– Infrastructure Planning Forum
Sep 2016*

Understand Users



*Understand User Needs
and Translate Them Into Requirements*

- **Requirements Exchange: 7,000+ entries to date in FY 2016**
 - **NCEI Customer Engagement Requirements Exchange (CEREx)**
 - Document, prioritize, and address requirements from customer and engagement interactions
 - Inform NCEI science, research, and data priorities
 - Continuously improve how NCEI serves and interacts with its customers
 - Enable capabilities in customer analytics
 - **Use-Inspired Products & Services Sustainment/Development**
 - Transparency (no-surprise environment) in decisions impacting products and services
 - Disciplined product development workflow, including user feedback

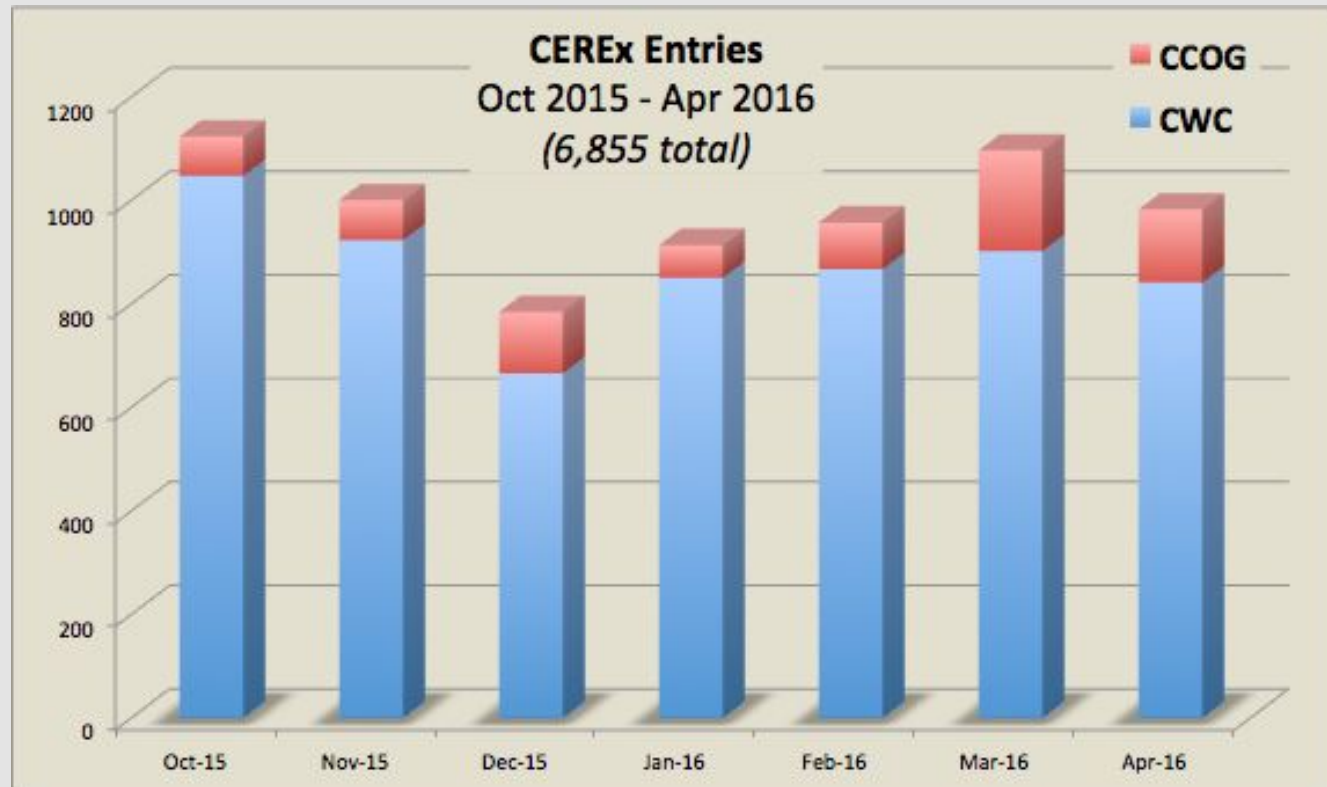
Analytics Levels:
Descriptive

Understand Users (Cont)



*Understand User Needs
and Translate Them Into Requirements*

- **Customer Engagement Requirements Exchange Trend**



Understand Users (Cont)



*Understand User Needs
and Translate Them Into Requirements*

- Sector-Based Use Cases**

Sector	NCEI Data	Outcome
<i>Agriculture</i>	Global Historical Climatology Network Daily (GHCN-D)	Optimal Nitrogen Management
<i>Aviation</i>	NEXRAD archive	Safer flying for the travelling public
<i>Natural resources (coral reefs)</i>	Pathfinder Climate Data Record (CDR)	Coral reef management
Video Link		

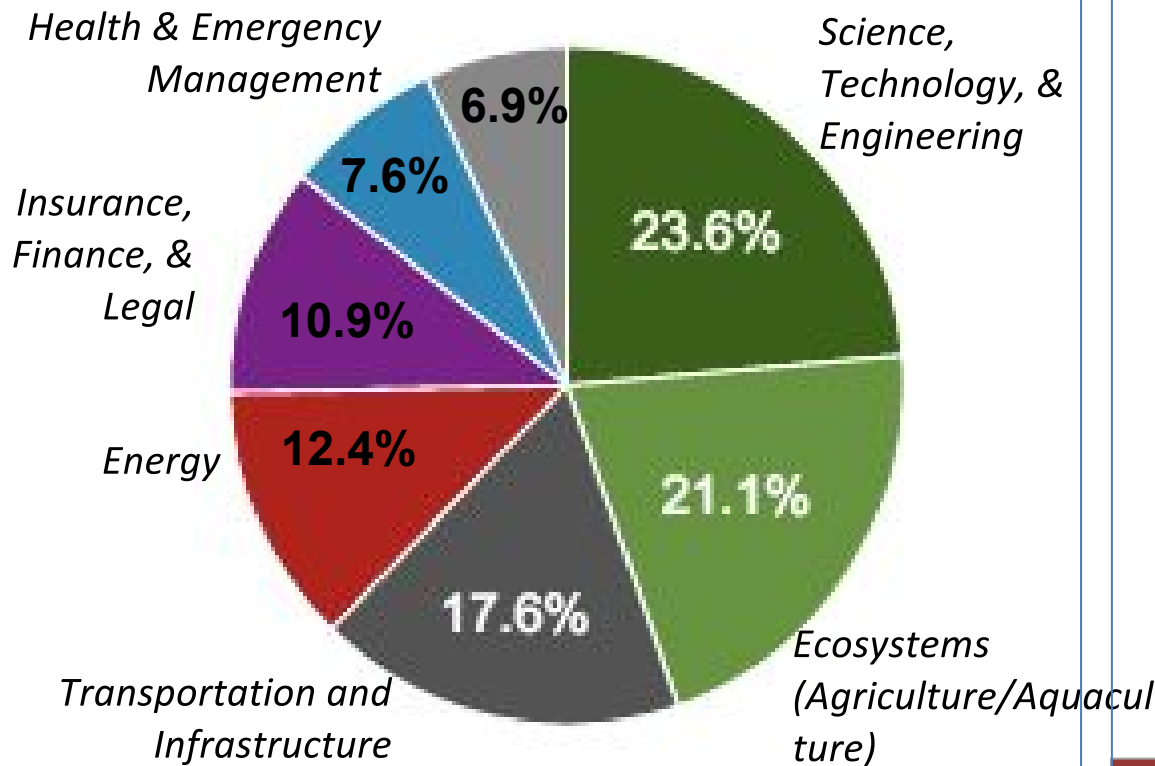


Understand Users (Cont)



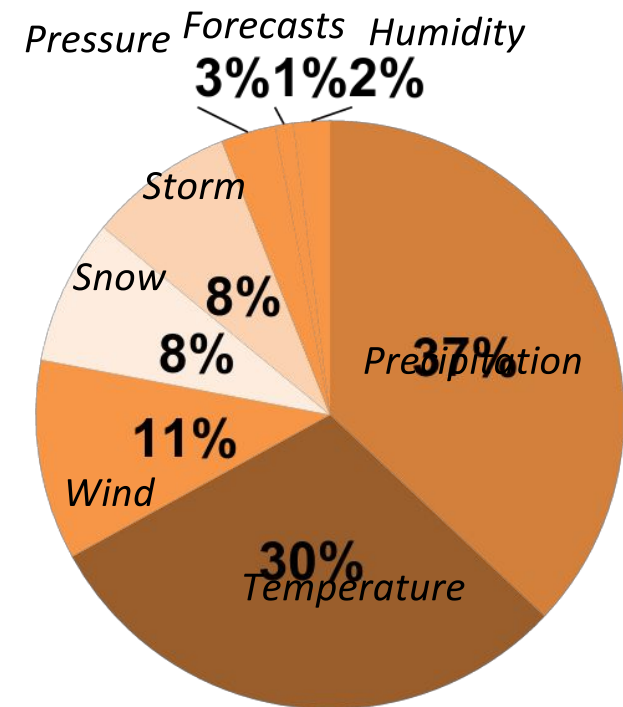
*Understand User Needs
and Translate Them Into Requirements*

By Targeted Sector



1,200 Stakeholders (March 2016)

CEREx Statistics (FY 2016)

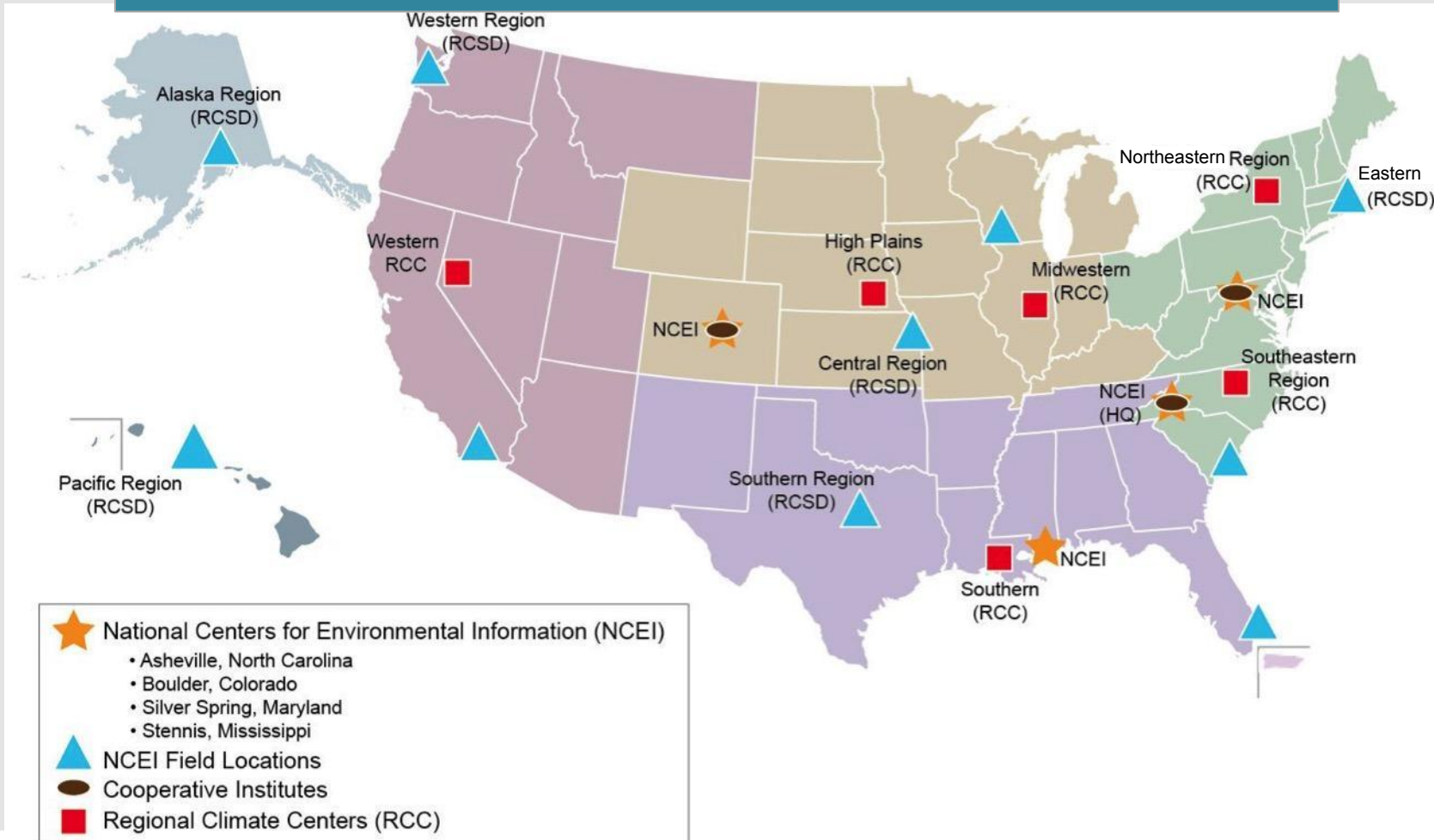


By Resolved Theme

Strengthen Networks



Strengthen Networks for Developing and Delivering NCEI's Products and Services



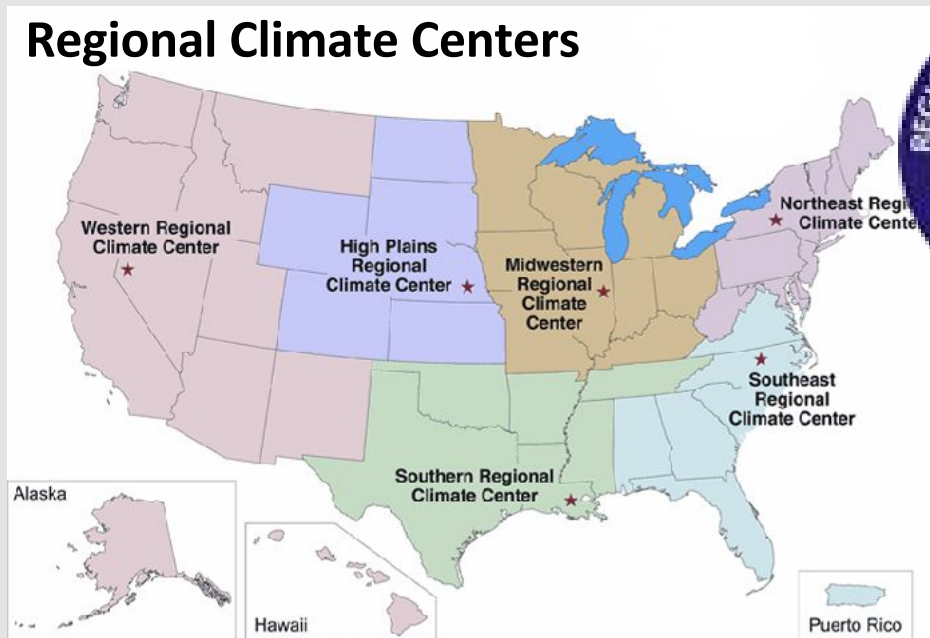
Strengthen Networks (Cont)



*Strengthen Networks for Developing and Delivering
NCEI's Products and Services*

National Partnership

Regional Climate Centers

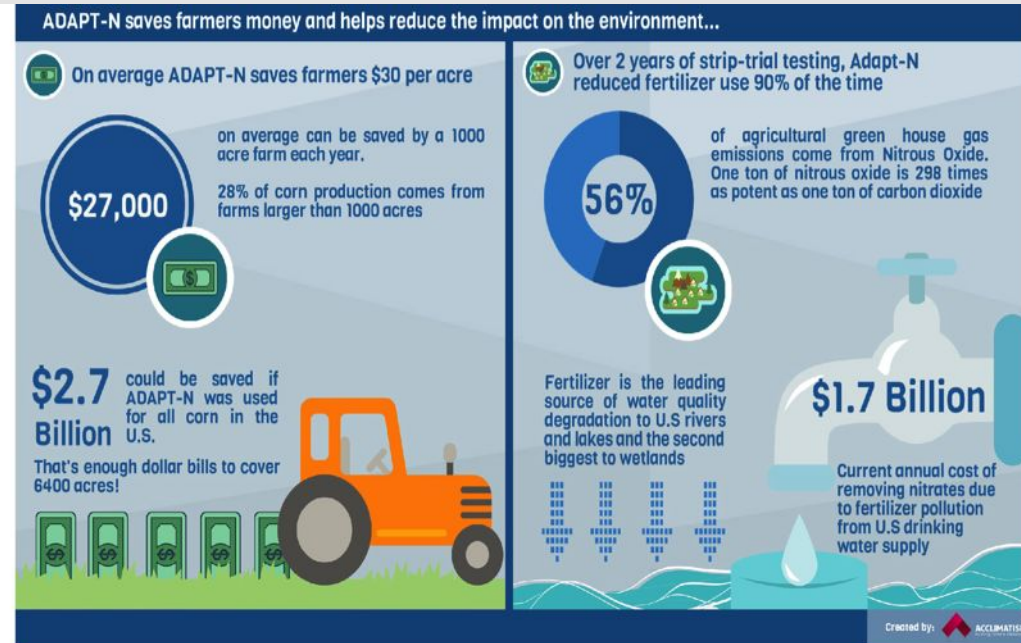
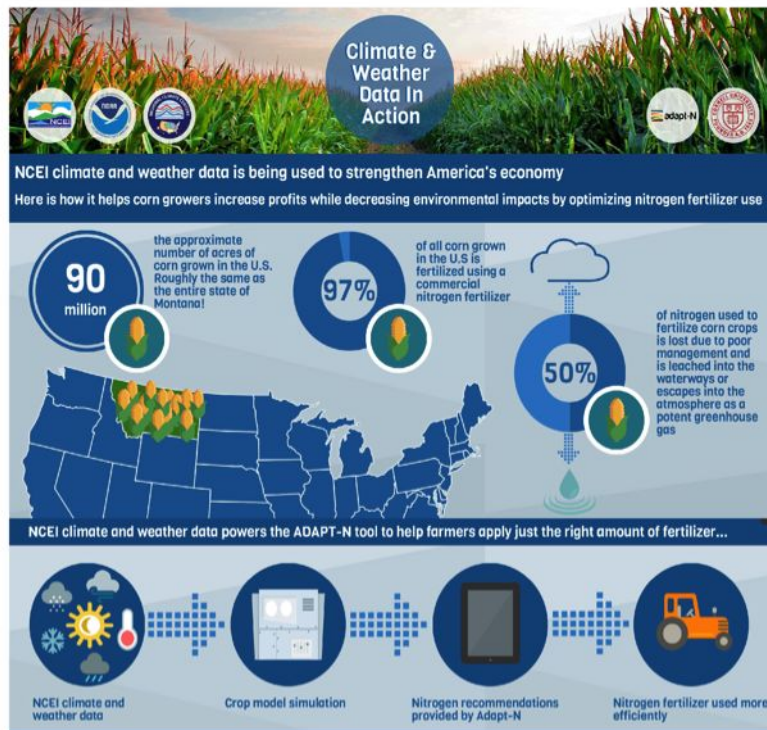


...and YOU!

Strengthen Networks (Cont)



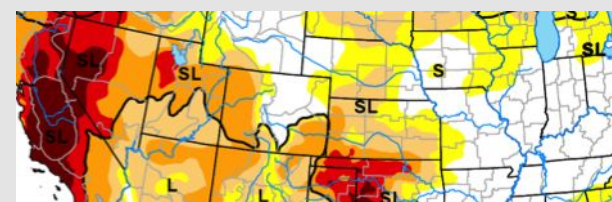
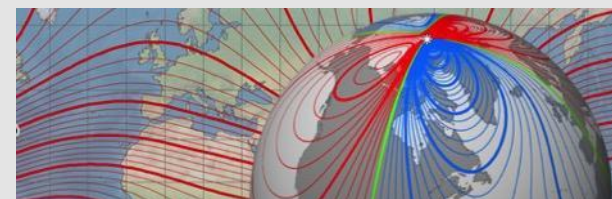
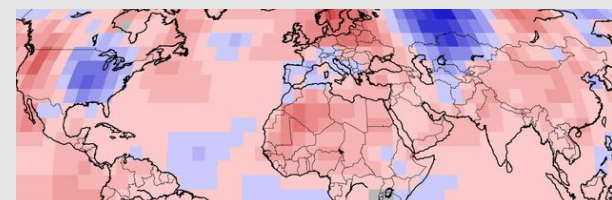
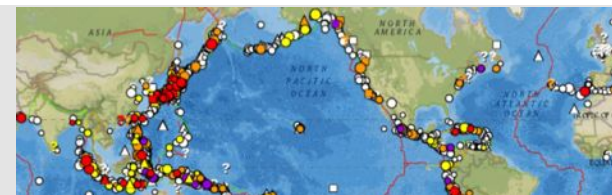
Example: Nitrogen Application Model for Corn

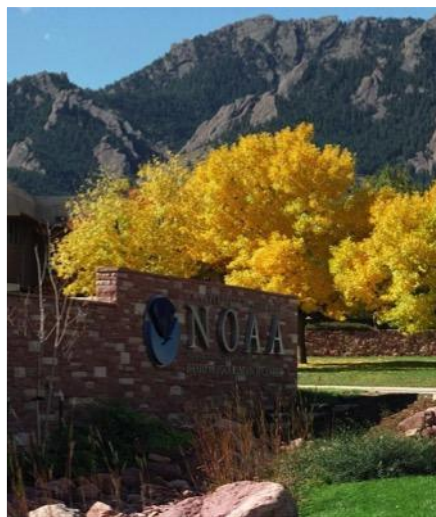


Value of NCEI

Science, *Regional* Services, Stewardship

- Comprehensive environmental information across economic/environmental sectors and science disciplines for decision making, planning, and operations
- Timely and authoritative data and information with well described origin and certainty
- Service to a wide-range of customers across government, academia and industry
- Preservation of data and information for future generations





NOAA/NESDIS National Centers for Environmental Information

www.ncei.noaa.gov



NCEI Climate Facebook: <http://www.facebook.com/NOAANCElclimate>

NCEI Ocean & Geophysics Facebook: <http://www.facebook.com/NOAANCEloceangeo>

NCEI Climate Twitter (@NOAANCElclimate): <http://www.twitter.com/NOAANCElclimate>

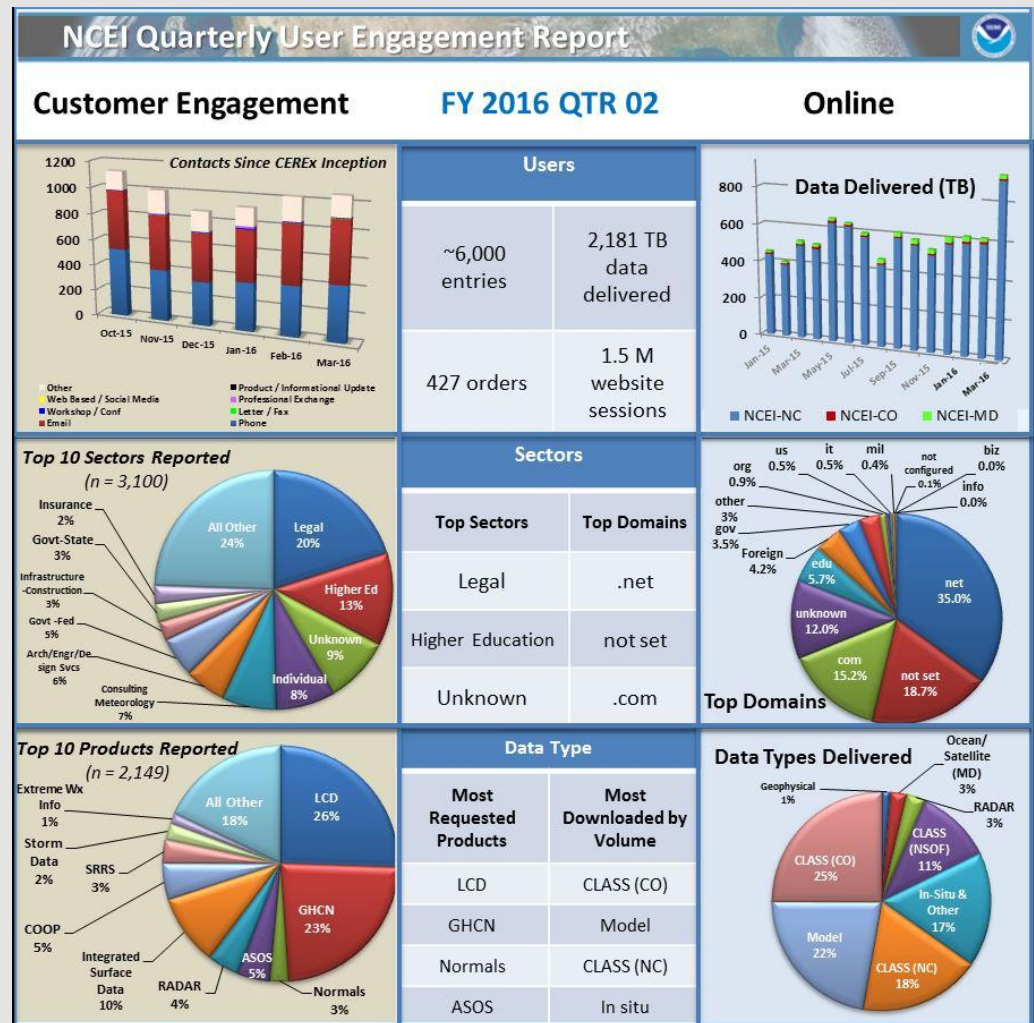
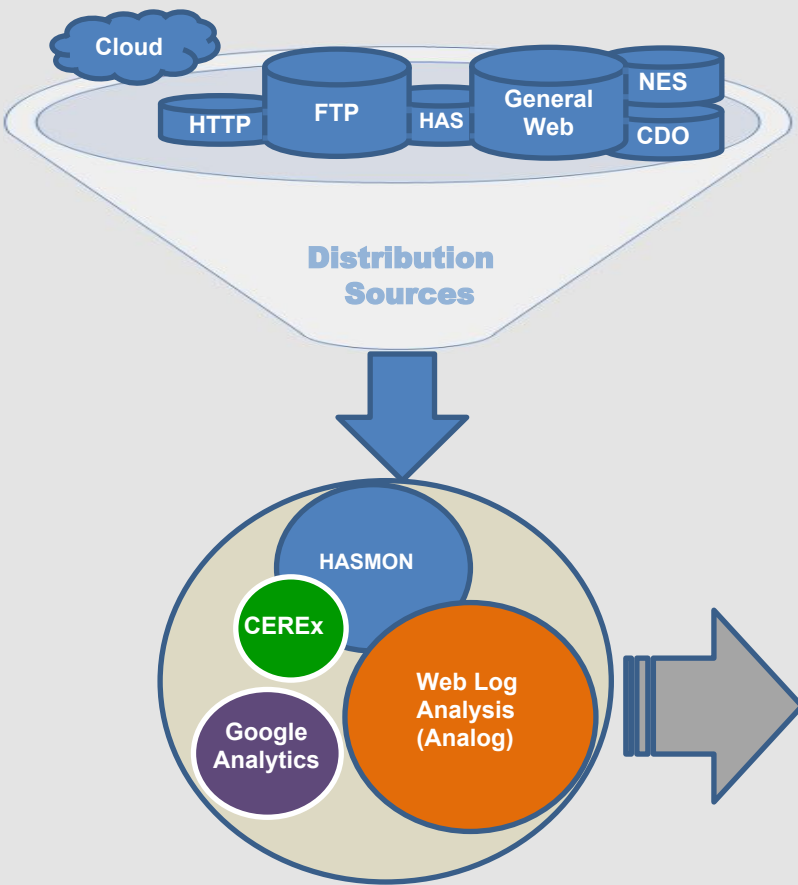
NCEI Ocean & Geophysics Twitter (@NOAANCElocngeo): <http://www.twitter.com/NOAANCElocngeo>



Backup Slides

- **Professional Association**: Representatives from over 60 different power and gas utilities in the U.S., Canada, and beyond
- **Benefit for NCEI**: Improved analytics for *services* support
 - Building upon infrastructure, data management, and data integration
 - Maturity Levels:
 - Descriptive Analytics – What?
 - Diagnostic Analytics – Why?
 - Predictive Analytics – When?
 - Prescriptive and Optimized Analytics – How?
- **Benefit from NCEI**: Products and services tailored for Energy Utilities
 - Support for on-staff meteorologists, consultants, data scientists
 - Product lines: Climate perspectives, near-term (72-hour) forecasting, climate outlooks; improved spatial/temporal granularity
- **Next Steps**: Terry Thompson/Tim Owen to talk with StormAnalytics WG

CEREx Analytics - An Integrated View



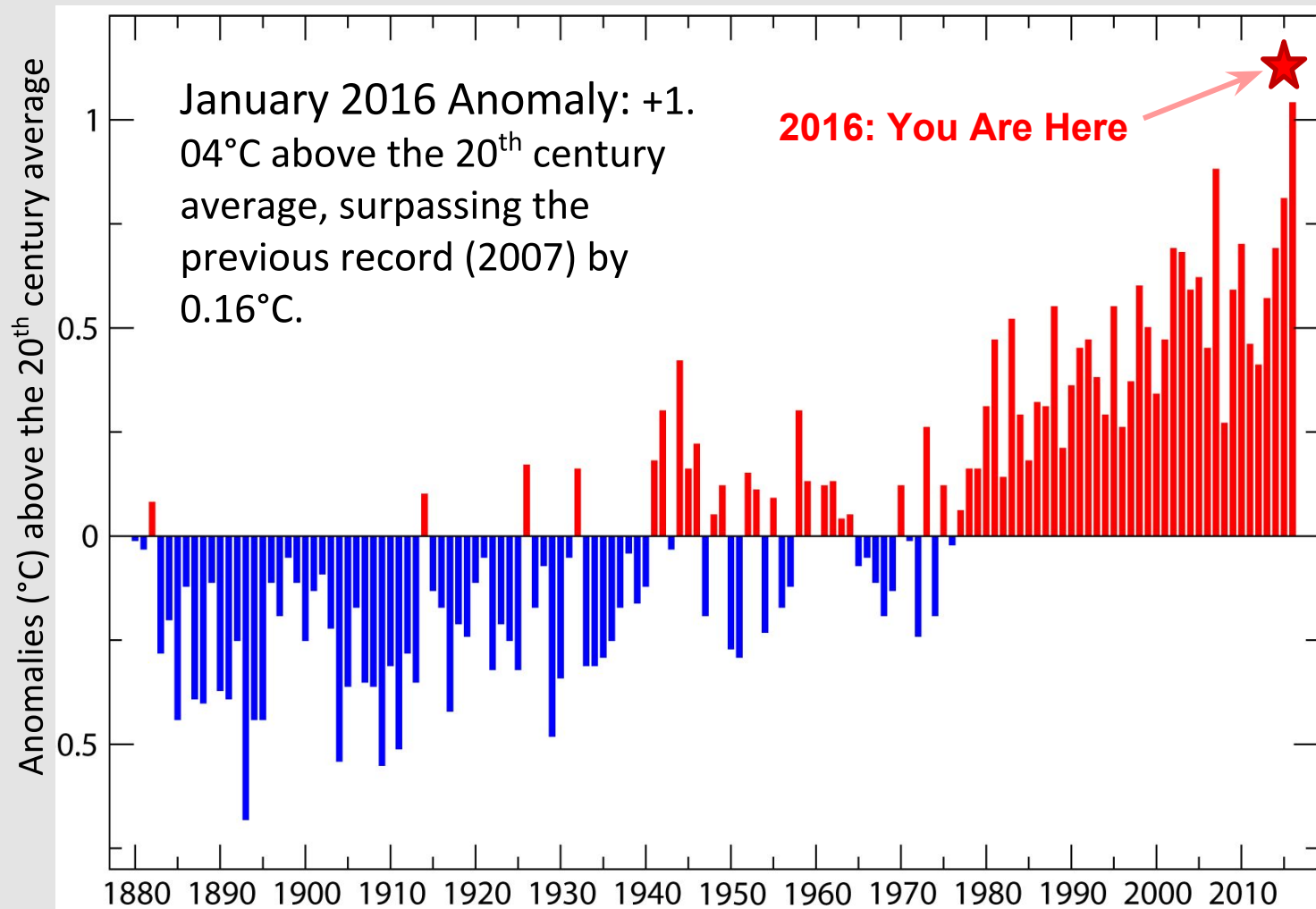
How do we Develop & Maintain “Gold Standard” Reference Datasets?

- Apply a maturity model similar to engineering readiness levels - a practical approach
- Goes beyond measurements of quality to *usability, transparency, and understanding*
- Assess products using a “Maturity Matrix” covering seven aspects of data maturity

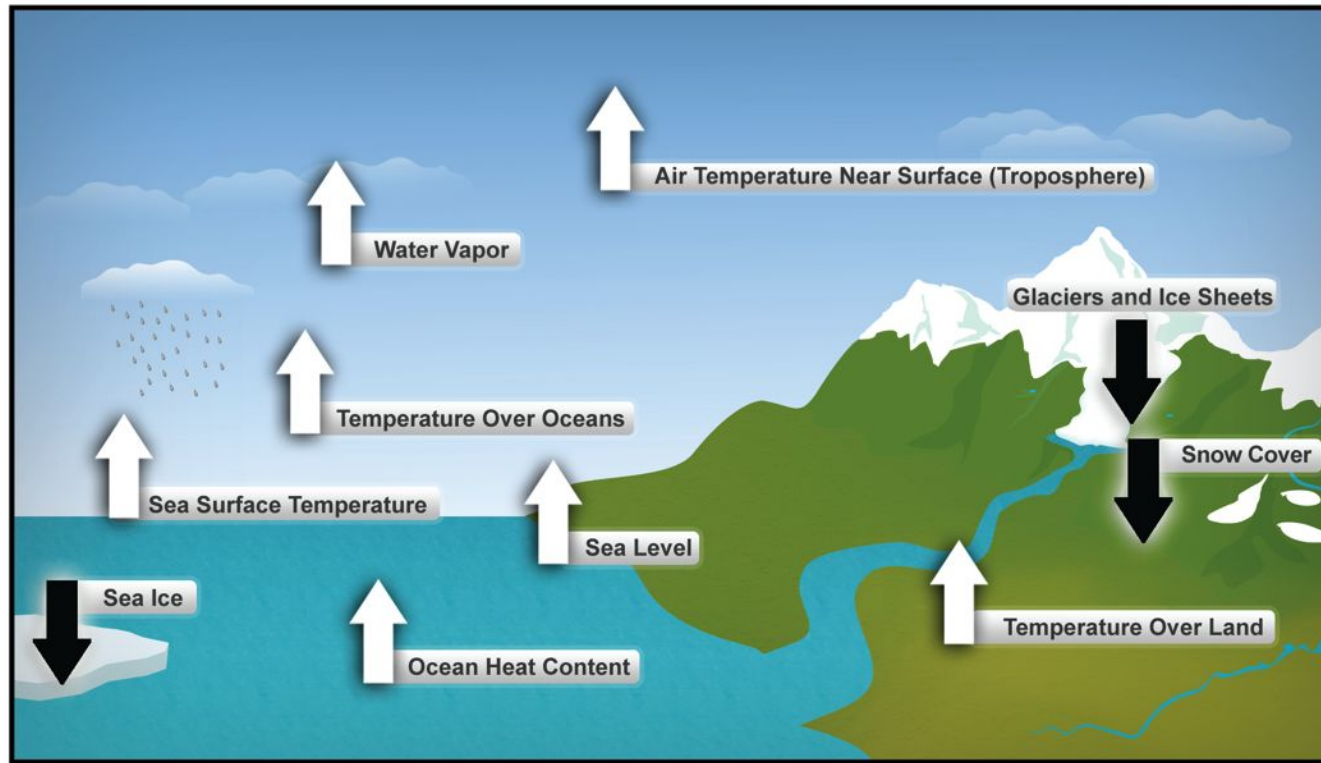
	Level	Data Use	Code Stability	Metadata & QA	Documentation	Validation	Public Release	Science & Applications
Primarily Operations	6	Unified and coherent record; considered scientifically irrefutable following extensive scrutiny	Homogeneous and published error budget	Provenance tracking and reproducibility; meets international standards	Peer-reviewed product algorithm, validation, processing and metadata	Validated independent cross-checks, open inspection, and continuous interrogation	Publicly available from long-term archives	Used in various published applications and assessments
	5	Unified and coherent record	Stable and reproducible	See below	See below	See below	Source code portable and released; uncertainty estimate	See below
	4	Research and Operations	See above	Provenance tracking and reproducibility; meets international standards	Draft Operational Algorithm Description	See below	Source code released; Data available but of unknown accuracy	See below
Primarily Development	3	Research	Minimal changes expected	See below	Peer-reviewed algorithm and product descriptions	Uncertainty estimated over widely distribute times/location; differences understood	See below	Provisionally used in applications and assessments demonstrating positive value
	2	Research	Some changes expected	Research grade (extensive)	CTD	Uncertainty estimated for select locations/time	Data available but of unknown accuracy	Limited or ongoing
	1	Research	Significant changes likely	Incomplete	Draft concept of Theory Document (CTD)	Minimal	Limited data availability	Little or none

INCREASING REQUIREMENTS

One Slide: Yes, it is getting warmer



Ten indicators of a warmer world



An 11th Indicator: Changing Extremes

Knowledge Varies by Event Type

